SYNCHRONOUS MONITORING AND REAL TIME TRACKING GARBAGE SYSTEM AND PUSH CARTS FOR SMART CITY ENVIRONMENT

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Abstract—

Everyday tons of waste is disposed into open sites. Improper waste management and transports leads to environmental pollution and diseases. The conventional methods are very tedious and unhygienic. The process involves manual monitoring and there is no tracking mechanism for the garbage carrying vehicles and garbage load. A new system can be developed to monitor the garbage vehicles in a particular ward of a corporation to obtain optimization in terms of route and garbage collection. The garbage vehicles and push carts can be fitted with sensors and based on the GPS location the vehicles can be monitored to cover all areas of the ward. The vehicles should be compartmentalized for dry and wet waste to avoid the mixing of garbage.

Keywords—tracking, optimization, sensors, GPS

I. INTRODUCTION

The garbage collection process is tedious, inefficient and time consuming. The process involves manual monitoring and there is no tracking mechanism for the garbage carrying vehicles and garbage load. A new system can be developed to monitor the garbage vehicles in a particular ward of a corporation to obtain optimization in terms of route and garbage collection. The garbage vehicles and push carts can be fitted with sensors and based on the GPS location the vehicles can be monitored to cover all areas of the ward. The push carts used to collect garbage are not designed correctly. Most of the garbage spills over the road during transportation. Battery operated carts can replace the existing push carts. In many cities of China, the point to point collection is done by battery operated vehicles and mostly driven by women. A node can be developed for a particular ward and monitored. A new app can be developed to help the citizens to locate the garbage vehicles and the timing of its arrival which helps in proper planning of disposal of garbage.

The Main Challenges associated with current way of garbage collection and monitoring are (i) Improper garbage level monitoring (ii)No door-to-door collection (iii)Absence of tracking mechanism (iv)Over-loading the final segregator.

According to Consolidated Annual Review Report On implementation Of Solid Waste management Rules, 2016, around 62 million tonnes of waste are annually generated in India. Due to the difficulties in the collection process and operation of the pushcarts and lack of tracking facility of the vehicles, only 43 million tonnes of the waste are collected. The remaining 19 million tonnes of waste remain uncollected, leading to displeasure and spreading of infections. The 11.9 million tonnes of the collected waste is treated by plants at dumpsite while remaining is used as compost for landfills. The cost of the segregator at the plant is around 7 lakh rupees which is really expensive and its accuracy of segregation is around 69 percentage only.

Source: [3]

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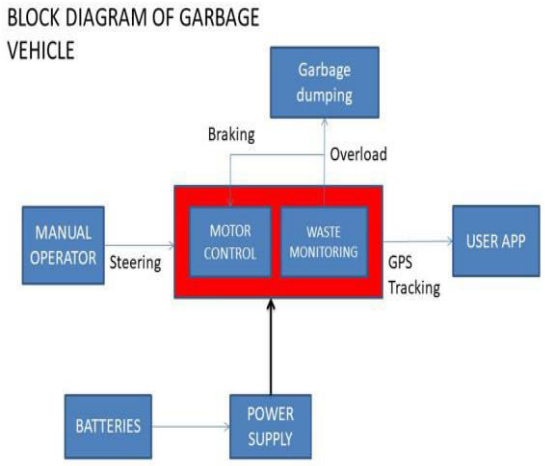
Lack of Automation in pushcarts lead to inefficient garbage collection and increased complexities thereby motivating us to come up with a solution for it.

II. METHODOLOGY

The proposed model has been divided into three parts.

1. **GARBAGE COLLECTION**
2. **MONITORING AND OVERLOAD DETECTION**
3. **TRACKING MECHANISM**

1. GARBAGE COLLECTION



I. PUSHCART

The pushcart helps the colony/locality to collect garbage from each house to the garbage bin. The pushcart can be tracked by the citizens. It consists of the following components

i. Microcontroller: Arduino Uno is the microcontroller used in the pushcart. It sends a signal to the motor driver based on the input it receives from the potentiometer.

ii. DC Encoder Motor: As the pushcart has to carry a large amount of load, so we require a motor with high torque. As a result, this motor is used. This is 24V DC motor which has a gearbox of 36mm diameter. It has 9000rpm and a stall torque of 562 N.cm.

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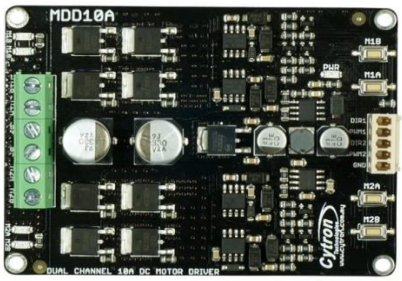
iii. Power Supply: Lipo batteries are used to power the motors. These batteries are rechargeable. The specification of the batteries is 7Ah, 24V.

iv. Motor Driver: This is used to prevent the back emf from the motor and helps in driving the motors. As a large amount of power is required to run the motor, Cytron DC Motor Driver is used, as it can handle a voltage of up to 25V.



v. Potentiometer: This is used to vary the speed of the pushcart. Pulse width modulation (PWM) is used to achieve this.

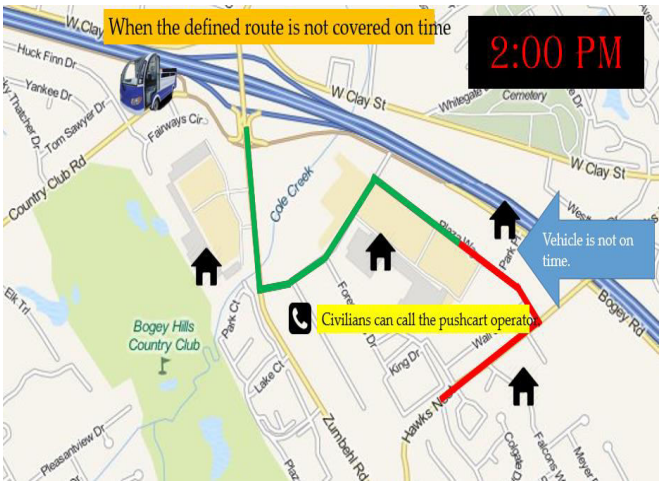
II. ROUTE OPTIMIZATION:

Route optimization is the process of determining the most efficient and cost-effective route for the vehicle. This problem is called as Vehicle Routing Problem (VRP).

The most optimized paths will be assigned to the various push carts. Since routes are fixed and limited, it is easy to assign optimized paths in every ward. The particular pushcart has to cover the given route in the given time frame. Each house is given some approximated time of push cart arrival. There will be mobile app showing the location of available carts. The red path shown in app has to be covered by the push cart every time. The path covered will be indicated with green colour.

Once the cart is deployed, it will cover the given path every time. The duration to collect the waste will be around three hours. Since the routes are fixed and assuming the certain time to cover a single house, the arrival time can be estimated for every house.

In case of delay, there is a two-step complaint mechanism. Civilians can call the pushcart operator in case of untimely delay. If otherwise, the user can send the message to the main operator of the ward.

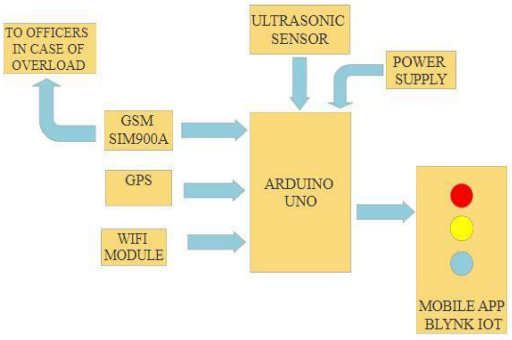


2. MONITORING AND OVERLOAD DETECTION:

i. GSM SIM900A Module: It is a chip used to establish communication between a mobile device or a computing machine and a GSM or GPRS system.

ii. Ultrasonic Sensor: It measures the distance to an object using ultrasonic sound waves, using a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.

BLOCK DIAGRAM OF OVERLOAD DETECTION



Using the GSM module, the overload condition can be informed to the respective officers. The level in which garbage is filled can be found out using the app developed using Blynk Iot Platform along with ultrasonic sensor.

3. TRACKING MECHANISM:

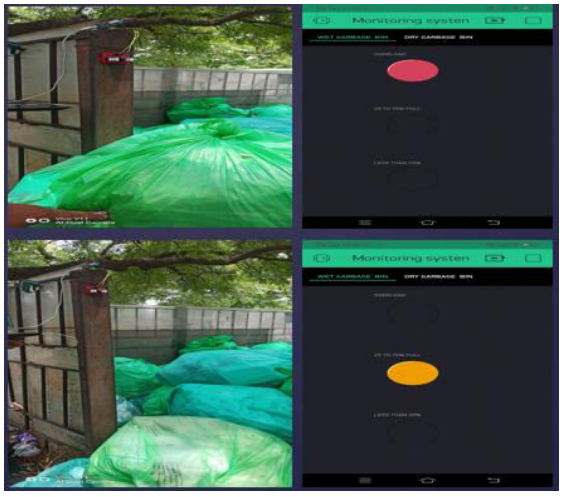
The location of the pushcart can be found using the app developed using Blynk Iot platform and GPS module. The people can use this app to know where the push cart currently is located.

III. CONCLUSION:

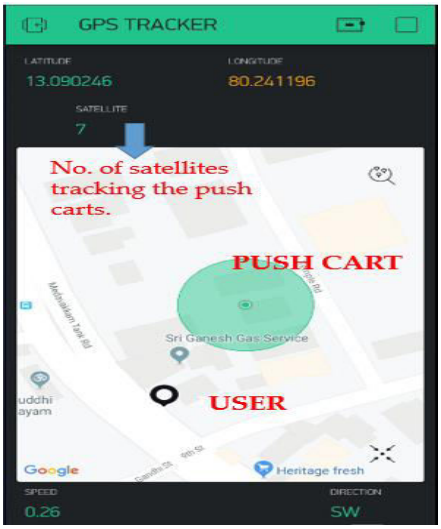
1. The app is developed using Blynk IoT platform. It displays the location of pushcart, user's location, speed, direction and other information.

2. The Pushcart is battery driven and consists of various dustbins where people can put dry, wet and metallic waste separately. The pushcart also contains the battery percentage display.

3. The app also displays the level of waste in the main dustbin which further avoids overflow. It has three indicators for three levels. When the ultrasonic sensor detects the waste above threshold, it notifies the concerned people.



4. When the threshold is exceeded, an SMS is sent to notify



the garbage vehicle driver. The supervisor can also access the app and monitor the collection process and track the garbage vehicle and status of the bin.

5. The shortest path of traversal is displayed to the driver so as to facilitate efficient collection process.

IV. RESULT:

The proposed model has a battery driven pushcart which does not need the manual power to drive it. It also displays the battery percentage of the pushcart. Further the pushcarts have a fixed path to cover a given area. It follows the optimized path to cover all the houses for collection. With the help of mobile app, one can track the location of pushcarts. At the disposal end, the dustbin consists of the ultrasonic sensors which help to avoid overflow.

The complete model when implemented properly overcomes the problems faced during waste collection and disposal.

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